Species of the Proteaceae are highly susceptible to P fertilisation (P-toxicity) at relatively low external [P]. Our recent findings discovered that the extreme P sensitivity of *H. prostrata* (Proteaceae) is due to its very low capacity to reduce its phosphate-uptake capacity at elevated P levels in the rhizosphere. In the south-west of Western Australia, root clusters are only produced during the Mediterranean wet winter. That is the time most nutrients are absorbed; since growth tends to occur during warmer and drier seasons, the nutrients must be stored. The lack of down-regulation of P uptake capacity is therefore in tune with the Mediterranean climate and the P-impoverished soil conditions in Western Australia.

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The carbon balance at Skukuza

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The main elements of the carbon cycle of a savanna ecosystem in the Kruger National Park, South Africa, have been investigated since 2001. The strong diurnal and seasonal cycles of Net Ecosystem Exchange of carbon dioxide are monitored on a continuous basis by the eddy covariance technique. Like many little-disturbed terrestrial ecosystems at the present time, this savanna is a weak net carbon sink: the downward daytime fluxes due to photosynthesis are slightly stronger than the upward night time fluxes due to respiration. The Net Biome Production remains positive despite the three fires that have been experienced over the measurement period. The highly-detailed flux data allow the ecosystem-scale controls on carbon assimilation and loss to be elucidated. Of particular interest in the context of future climate change is the net carbon exchange when temperatures are high, especially in the presence of water stress. Novel techniques have been applied for separating the tree and grass contributions to the fluxes, and for distinguishing root respiration from soil respiration.

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Plants and plant extracts for manipulating ruminal fermentation

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The threat to human health associated with the use of antibiotic and chemical feed additives has prompted legislation in the EU to ban antimicrobial growth promoters (AGP), and has accelerated investigations into plants and their extracts as feed additives. The broad potential of plants and their extracts to replace AGP is illustrated by the progress of an EC Framework 5 project, 'Rumen-up' and its Framework 6 successor, 'Replace'. The Rumen-up project began with a targetted collection of 500 European plants and their extracts, and partners tested their effects on ruminal proteolysis, protozoa, methanogenesis and lactate production. A success rate of about 5% in terms of positive hits illustrated that phytochemicals have great potential as 'natural' manipulators of rumen fermentation, to the potential benefit of the farmer and the environment. Some of the positive samples exerted their effect via their essential oils or saponins content. The mode of action of these phytochemicals is at least partially understood. Dietary inclusion of a commercial blend of essential oil compounds caused significantly decreased NH_3 production from amino acids in ruminal fluid taken from sheep and cattle. This effect was mediated partly by effects on ammonia-producing bacteria and on the protein and starch fermenter, *Ruminobacter amylophilus*. Saponins-containing plants and their extracts suppress the bacteriolytic activity of rumen ciliate protozoa, thereby enhancing total microbial protein flow from the rumen. The effects of some saponins are transient, because they are hydrolysed by bacteria to their corresponding sapogenin aglycones, which are much less toxic to protozoa. Saponins also have selective antibacterial effects which may prove useful in, for example, controlling starch digestion. The Rumen-up project also highlighted potentially useful plants which had a benefit that could not be explained by our present knowledge of the effects of phytochemicals on ruminal microorganisms.

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Plant ecological strategies

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Plant ecological strategy schemes aim to express the variety of ways different plant species make a living. In order to be able to compare species worldwide, we have focused on measurable species traits rather than on concepts such as competitiveness or stress-tolerance. Larger seed size improves each offspring's chance of survival during seedling establishment, at the expense of numbers of offspring produced per unit reproductive effort. The resulting compromise has been struck at seed sizes that vary enormously across species, and are loosely correlated with size of the adult plant. A spectrum of "leaf economics" runs from cheaply-constructed leaf area with short lifespan and quick returns on investment, to leaf area that is more expensive initially but returns revenue over a